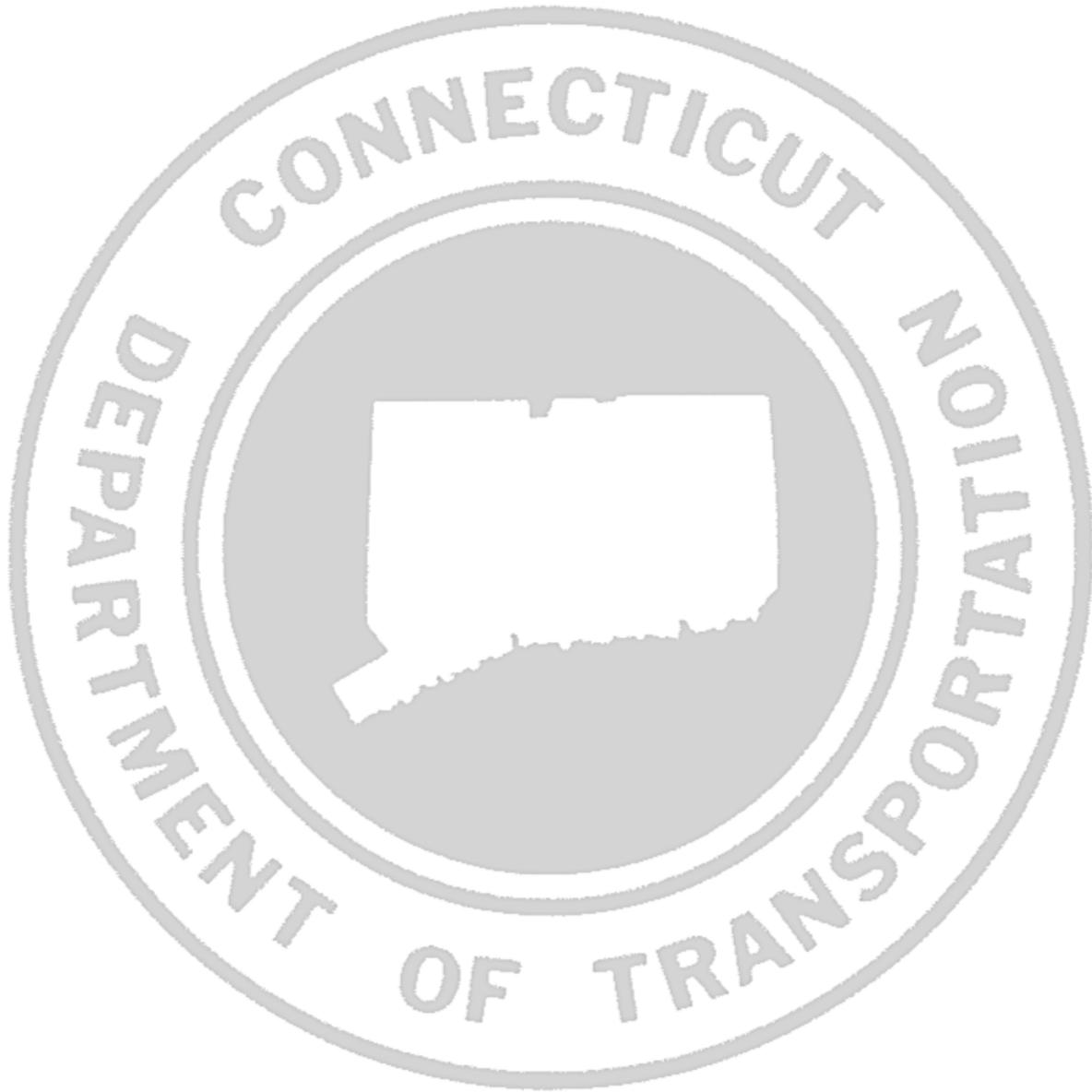


Connecticut Department of Transportation



Workflow for InRoads Export to HEC-RAS

The Office of Architectural, Engineering and Construction Applications

Division of Design Services

2800 Berlin Turnpike • Room 3213

Newington, CT 06131

Phone: 860.594.3320 • Fax: 860.594.3372

Thanks!

Thanks go out to all that contributed to the creation of this document, especially to Michael Kelly who assisted with the development and writing and to Nicholas Langer who reviewed and edited; To the staff of Hydraulic & Drainage unit for their support and first hands on use. The support that they provided has been invaluable and is appreciated beyond measure.

Gabriele Hallock

Distribution

This manual, in its entirety, may be freely copied and distributed for the purpose of providing a consistent guide to import InRoads data to HEC-RAS.

Trademarks

“MicroStation” and “InRoads”, are registered trademarks of Bentley Systems, Incorporated. Other trade names, computer protocols, and file formats mentioned in this manual are the trademarks of their respective owners. In no event will the appearance of any graphic, description of a graphic, picture, screen display, or any other method of conveying meaning, be considered to impair the rights of the respective owners.

Introduction

This workflow was put together to help engineers create InRoads cross sections for import to HEC-RAS. **This workflow should be used in conjunction with the CTDOT InRoads V8i Guide.**

Basically InRoads creates and gets its information from the 3-D surface models (DTM's). For most Hydraulic designs the survey digital terrain model - DTM needs be requested and copied. In some instances the Highway design model will need to be requested and combined, i.e. merged with the existing model. Most design elements that InRoads creates and/or references on the surface models are referred to as Features. For example, the stream alignment that you will create in InRoads for the HEC-RAS analysis is a Feature. MicroStation, from an InRoads perspective, creates graphic elements and in general InRoads will not perform an operation on a graphic element. In the following instructions, you will be directed to perform some operations using MicroStation and some operations using InRoads, be aware which program menu you are directed to. Be aware that the InRoads program does not save anything automatically – **You must save your work before exiting the program or you will lose your work.** Also, there is no “UNDO” command in InRoads. You can modify and delete a feature that you created in InRoads. InRoads will draw profiles and cross sections within the same MicroStation design file that you are working in. If you place the “graphic” elements in the wrong place you can delete them and recreate them very easily. If you use the survey file SV_MST_D#_XXXX_YYYY_GRN.dgn (most often named) your design should be in the geo-referenced location. These instructions are very basic and only deal with extracting information needed to create HEC-RAS cross sections. For a HEC-RAS analysis, it is probably easier to modify the HEC-RAS model within the HEC_RAS program.

Table of Contents

SECTION 1 STARTING HEC-RAS/INROADS PROJECT	5
1.1 InRoads File Types	5
1.2 Resource File Storage Location	5
1.3 Starting the InRoads Application.....	6
1.3.1 LAB – 1 Starting HEC-RAS InRoads Project.....	6
1.4 InRoads Interface and InRoads Explorer Windows.....	9
1.5 Project Defaults and Options for HEC-RAS InRoads Project	9
1.5.1 LAB – 2 Setting Up InRoads Files.....	10
1.6 Setting up Project File (*.rwk)	12
SECTION 2 SURFACES.....	14
2.1 Types of DTM Display.....	14
2.2 Features in the DTM.....	14
2.3 Surface Tools	15
2.3.1 LAB – 3 Copy Surface	15
2.4 Creating Horizontal Alignment.....	16
2.4.1 LAB – 4 Creating Horizontal Alignment	17
2.5 Creating and Importing Surfaces Features.....	18
2.5.1 LAB – 5 Creating and Importing Surface Features	18
SECTION 3 PROFILE AND CROSS SECTIONS	22
3.1 Profile	22
3.1.1 LAB – 6 Profile	22
3.2 Cross Sections.....	23
3.2.1 LAB -7 Cross Sections	23
SECTION 4 HEC-RAS SECTIONS	25
4.1 Create HEC-RAS Sections.....	25
4.1.1 LAB – 8 Develop HEC-RAS Sections.....	25
SECTION 5 IMPORT INROADS DATA TO HEC-RAS.....	27

Section 1 Starting HEC-RAS/InRoads Project

1.1 InRoads File Types

See this section in the CTDOT InRoads V8i Guide for full information. The InRoads design process uses several different file types. All InRoads data is stored in external files. The CAD file is used to view a graphical representation of the design data, but the graphics files do not store the InRoads Data.

The following InRoads resource files have been configured especially for the HEC-RAS & V8i Environment (for a complete list see CTDOT-IR-V8i Guide):

Preference File (*.xin) - This file contains the control settings of all the dialog boxes within InRoads. The settings for surface, geometry and survey tools are all confined within the .xin file. This is the main source of standardization where all InRoads design and graphical output are configured to meet CTDOT standards.

Drafting Notes (*.dft) - This file is used to enhance the production of final drawings. Use the commands across the design session to place intelligent annotation notes on features and geometry, in the plan, profile, and cross section views.

The following InRoads files need to be created for the HEC-RAS project design:

Projects (*.rwk) - This file contains directory and file information for loading and saving InRoads data files. Once the project file is open, all of the specific project files are also opened.

Geometry Projects (*.alg) – This file contains coordinate geometry and alignment information for a specific geometric project.

1.2 Resource File Storage Location

The latest versions of all V8i resource files will be kept in the workspace under **InRoads_V8i _RSC**. Before starting an InRoads project, copy the necessary files from the workspace into the designated folder. Resource files for Hydraulic and Drainage users are copied into the Hydro discipline folder within the project container.



V8_Environment folder (W:\Workspace\InRoads_V8i_RSC) holds all of the resource files needed to run InRoads Select Series with the V8 level structure.

1.3 Starting the InRoads Application

Using Window Explorer: CTDOT users should ensure the **W:\drive** is mapped (CTDOT_V8 Workspaces > Workspace). If not mapped, please contact Helpdesk via email or phone extension 3500, option 1.

Other users should go to the ConnDOT webpage: ConnDOT: **CTDOT - SELECTseries DDE** and follow the instructions.

1.3.1 LAB – 1 Starting HEC-RAS InRoads Project

A. Before resource files can be copied into the Hydro project directory an InRoads and HEC-RAS folder need to be created. Browse to your specific project folder and create in the **Hydro** folder two subfolders; one named **InRoads**, another named **HEC-RAS**. For this lab use: 999_StudentXX_2007 or create a project folder on your computer's D-drive.

B. In Windows Explorer, browse to the workspace folder **V8 Workspaces > Workspace > InRoads_V8i_RSC\V8_Environment**. From there copy the following files to the InRoads project folder you just created:

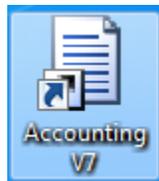
CT_civil.XIN

CT_notes.dft

HW_typicals.itl (only needed when creating proposed features)

C. For this lab copy to the following folders: **\999_Student##_2007\Hydro\InRoads** (or to the folder you created on your computer).

D. Double Click on the **Accounting icon** located on your desktop.



Windows 7

E. Within the CT DOT Accounting Menu select **Run Program:** (1), choose **MS 8i Hydraulics** (Highway). Select the project number for your project from the Available Accounts (2) and then highlight it within the Frequently Used Accounts (3). Select the correct Resource Type (4) and click on Start (5) button, see Figure 1.

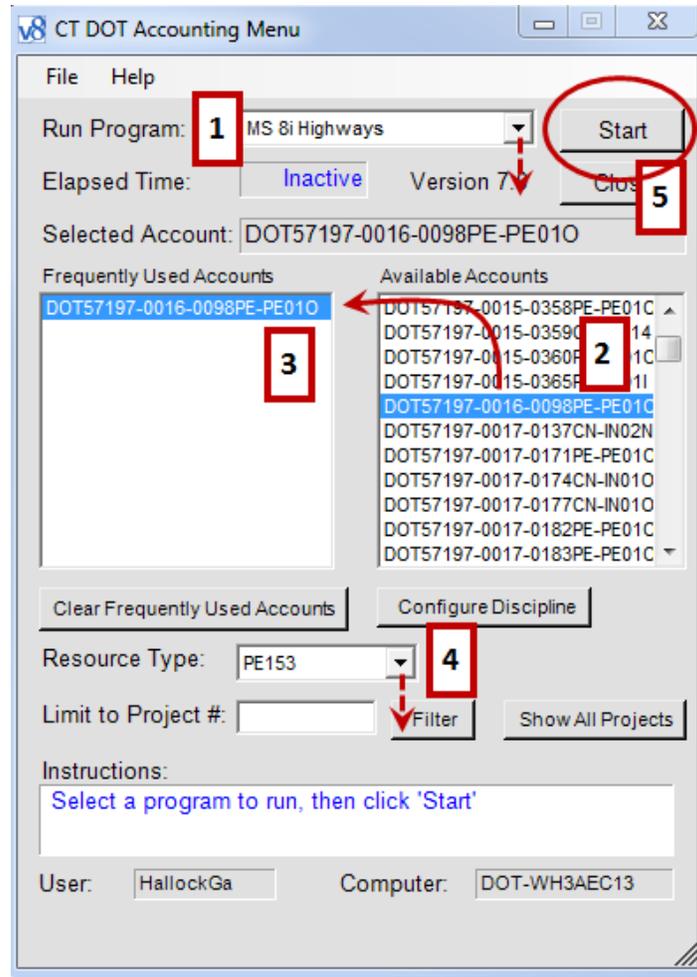


Figure 1 - Accounting Menu

- F. The **first time** into MicroStation V8i follow the **CTDOT-IR-V8i Guide**. When the MicroStation Manager opens, select the project number (for this lab: **999_Student##_2007**) or the project on your hard drive. Browse to the **Hydro folder** and create a 3D design file in MicroStation.
- G. In the MicroStation Manger window, select the **new file** icon (Figure 2). Click on the **Browse** button to select a 3D seed file. Select and open the following seed file:
CTDOT_V8_Workspaces\Workspace\Standards\seed\CT_Design_3D_V8i.dgn.

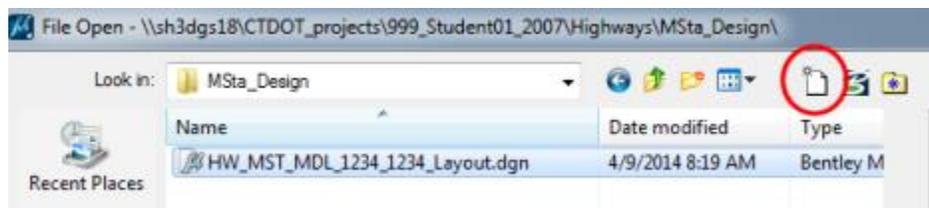


Figure 2 - New File

- H. Type in a **file name**, for this lab: **Ex_Channel** and click on **Save**. Now **double-click** the file to open it.
- I. Reference in the Survey file and the Highway design file if needed. For this lab we reference in the survey file only. In MicroStation click on **References icon**, click on **Tools > Attach...** Browse to the survey directory for your project and click on the survey dgn file. Click **open**. For this lab: In the survey folder select **SV_D1_0123_4567_GRN.dgn**. Select **no nesting** and click **off raster**, click **OK**. **Close** the References box, see Figure 3.

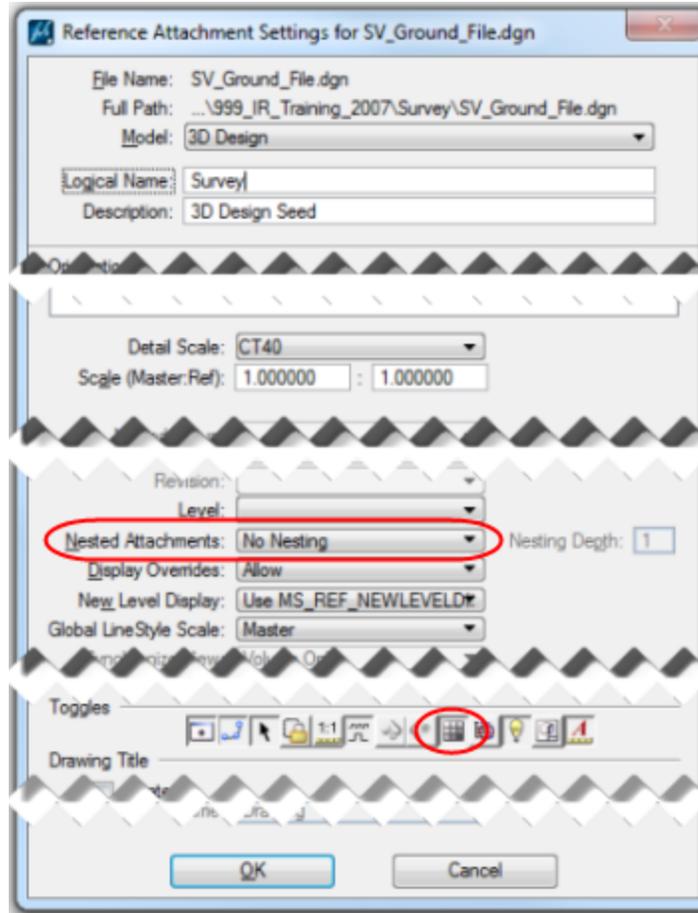


Figure 3 Attach Reference File

- J. In the MicroStation window click on **Fit View**.  Open **Level Display**  and **turn off Levels** in the survey file that are not needed, such as border and various texts. Repeat these steps with the highway design file if attaching, not needed for this lab. **Close** the Level Display box.

- K. In MicroStation click on **File > Save Settings**. This saves the settings and views for when you reopen this file the next time.
- L. Open InRoads. In the MicroStation menu bar, select **Applications > InRoads Group > Activate InRoads Suite**, see Figure 4.

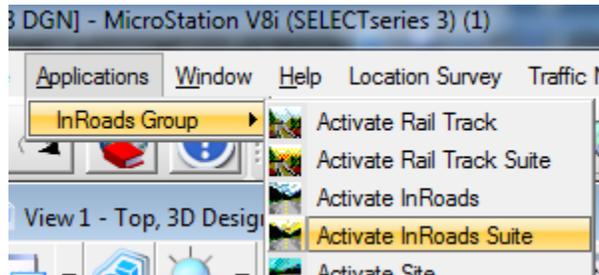


Figure 4 - Open InRoads

1.4 InRoads Interface and InRoads Explorer Windows

When the InRoads application is opened, the InRoads Explorer will appear. Right-Click in the gray space within the menu bar to open the shortcut to the **LOCKS** tool bar. See the CTDOT-IR-V8i Guide for further explanations.

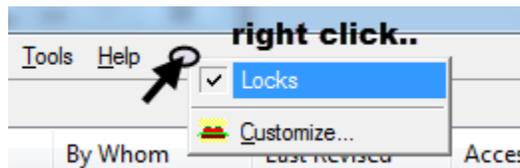


Figure 5 - Locks

1.5 Project Defaults and Options for HEC-RAS InRoads Project

An organized work environment along with a standardized file management system provides a consistent way to maintain digital design data.

To ensure file integrity, the correct project files must not only be used, but also maintained and updated.

InRoads users must master file management techniques for all InRoads design and data files. By setting up the project defaults and creating a project file, users can quickly load all files needed for project design. Additionally, the project file helps coworkers load and analyze current design data.

The Project Defaults command is used to open resource files including the preferences file (.xin), Storm and Sanitary files, drafting file, and the master item database. This command is also used to set up default directories for all file types that can be accessed through the

File/Open and File/Save As dialog boxes. These include Project (.rwk), Surface (.dtm), Geometry (.alg), and Typical Section Library (.itl); see the CTDOT-IR-V8i Guide for further file types. All other files, which are opened or saved throughout the InRoads program, use the Project Default Directory setting. The project default file directories are stored in the computer's registry on the local hard drive.

- The **automated method** based on variables, will not be used for HEC-RAS InRoads projects. See the CTDOT-IR-V8i Guide for further assistance.
- The **conventional method** allows each project to have its own Configuration Name based on hard-coded paths. When a particular configuration is saved and users exit the dialog, that configuration is remembered as the "Current" configuration. The next time InRoads is accessed all the directory paths are set according to the last configuration used. If the project has been changed, users will need to select the corresponding project configurations when opening a project. This means a configuration name will be needed for every project that the user is working on.

1.5.1 LAB – 2. A Setting Up InRoads Files

- A. Click to **File > Project Defaults** on the InRoads Main Menu. See Figure 6.
- B. Click on the **New** button and a new dialog box will appear, type in your project number (XXX_XXXX) – for this lab type in **Hydro-1** for the configuration, click **OK** to save.
- C. Click the cursor in the **Preferences (*.xin)** box and click the **Browse** button. The Open box will appear. Browse to the location of the **CT_civil.xin** file that was previously saved into the Hydro folder, click **Open**, Repeat for **Drafting Notes**.
- D. Set Default Directory Paths, click the cursor in the **Project Default Directory** and click the **Browse** button. The Open box will appear. Browse to the location where the InRoads project will be stored, i.e. the project folder **InRoads** directory. Click **Open**.
- E. Repeat for all other paths or copy and paste. With the exception on Style Sheet and Survey Data (leave blank).
- F. For **Style Sheet** browse to **C:\Bentley_V8i\Civil\InRoads Group V8.11\XML Data** (or where InRoads is installed).
- G. To **save** the configuration, click the **Apply** button and then click the **Close** button.

- H. Open Project Defaults again to define **Discipline Settings**. Under **Preferred Preference** (bottom right of Set Project Defaults) select the required discipline name. Use **Highway** preferences. Click **Apply**, click **Close**.
- I. From the InRoads Menu Bar select **File > Project Options**.
- J. Select the **General Tab** then select the **Preferences** Button and data point on the **Highway** preference. Select **Load** and **Close**.

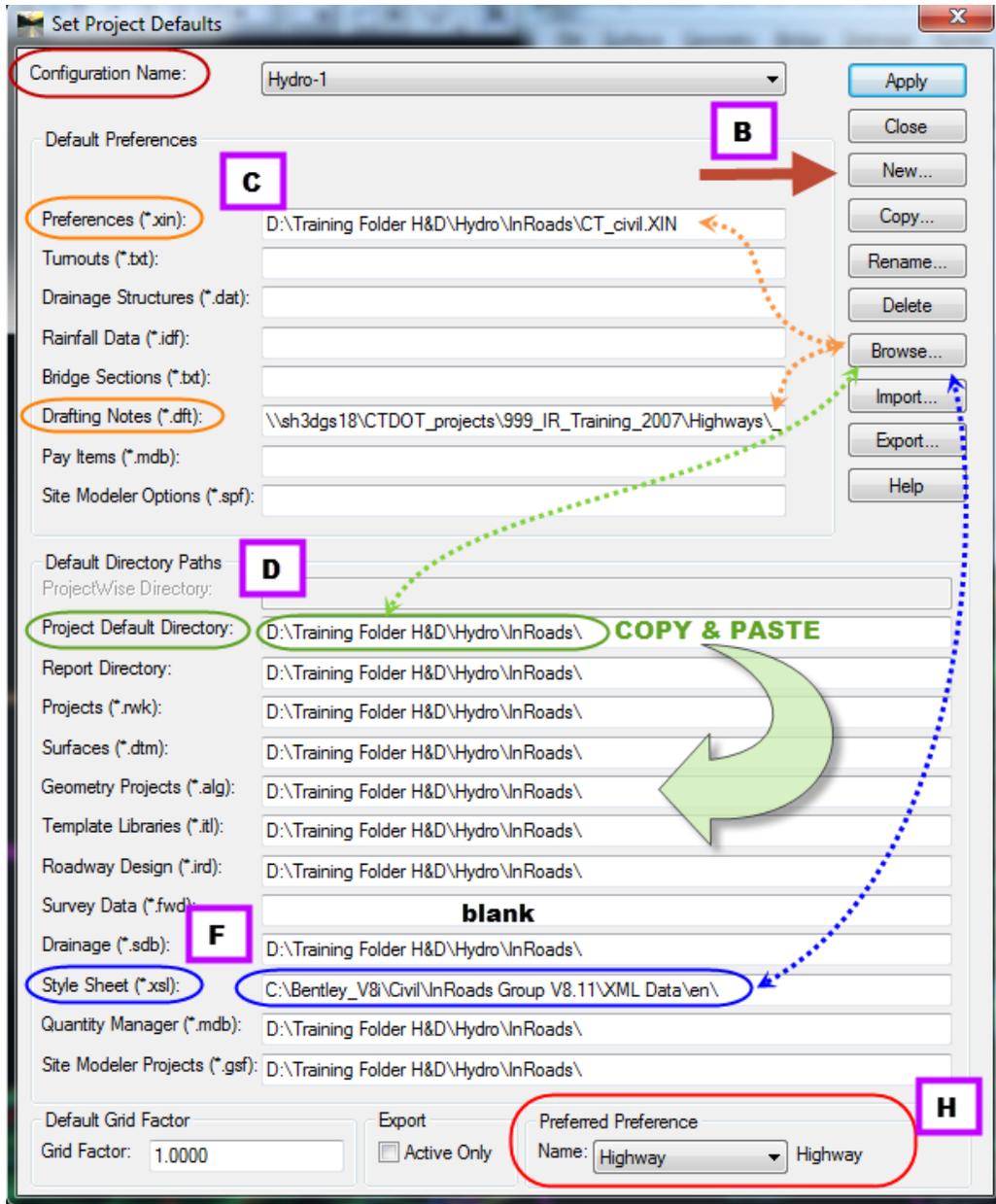


Figure 6 - Project Defaults

1.6 Setting up Project File (*.rwk)

The Projects File (*.rwk) is composed of a list of files that pertain to a specific project's design data. Surfaces, a template library, geometry projects, can all be saved to the projects file. When saving project files, the InRoads program places the entire path name in the .rwk file. If any of the files are moved, the .rwk file is invalid. Whenever the .rwk file is loaded, the software looks for the associated files in the same directory that the .rwk resides.

1.6.1 LAB – 2. B Setting Up InRoads Files

- A. Click **File > Open** on the InRoads Main Menu. Change the Files of type to ***.itl** and select **HW_typicals.itl**. Click **Open**
- B. Change the Files of type to ***.dtm**. Browse to the projects survey folder and click on the needed dtm. For this lab use **0123_4567ex.dtm**. Click **Open** and then **Cancel**.
- C. Create the **.alg file** (Geometry Project). This command does not create an actual file, it only creates an internal name for the Geometry Project. It needs to be saved.
- D. Click **File > New**. Click on the **Geometry tab** and type in a logical name, for this lab: **Hydro-1** in the name box, you can add **Existing Channel** as Description. Click **Apply**.
- E. Change Type to **Horizontal Alignment** and type in a logical name, for this lab: **Hydro-1**, set Style: **Ex_CL_Channel**, Curve Definition: **Arc**, Click **Apply**.
- F. Change Type to **Vertical Alignment** and type in a logical name, for this lab: **Hydro-1**, set Style: **Ex_CL_Channel**, Curve Definition: **Parabolic**, Click **Apply**. Click **Close**.

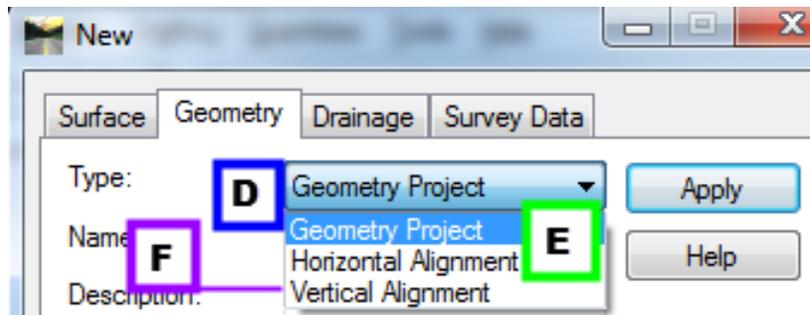


Figure 7 - Create Geometry Project

- G. Save the .alg (Geometry Project) file. Click to **File > Save > Geometry Project** on the InRoads Menu Bar. Click on the Active space and select your geometry. For this lab: **Hydro-1**. The File name will appear in the File Name Box. Click **Save**, and after the file is saved, click **Cancel**.

Connecticut Department of Transportation Workflow for InRoads Export to HEC-RAS

- H. Save files in the RWK (Project), see Figure 8. Click to **File > Save As** on the InRoads Main Menu. Select the Save as type: **Projects (*.rwk)**.
- I. Click the **Options (...)** button on the lower right corner of the 'Save As' dialog box. The **Project Options** dialog box will appear.
- J. Click on the **Surfaces Tab**, click on **Add** for the **Existing surface**. Other surfaces will be created later, and checked off under Add and Update.
- K. Click on the **Geometry Project Tab**, check on **Add** and **Update** for the **Hydro-1** geometry project just created.
- L. Click on the **XIN Preferences Tab**, check on **Add** and **Update** for the **CT_civil.XIN** saved to the project InRoads folder.
- M. Click on **Template Library**; check **Add** and **Update** for the HW_typicals. Click the **OK** button and the Project Options dialog box will close.
- N. On the Save As dialog box **data point** in the File name field and type in the name of the file e.g. **Hydro-1**. Click the **Save** button and then click **Cancel**.

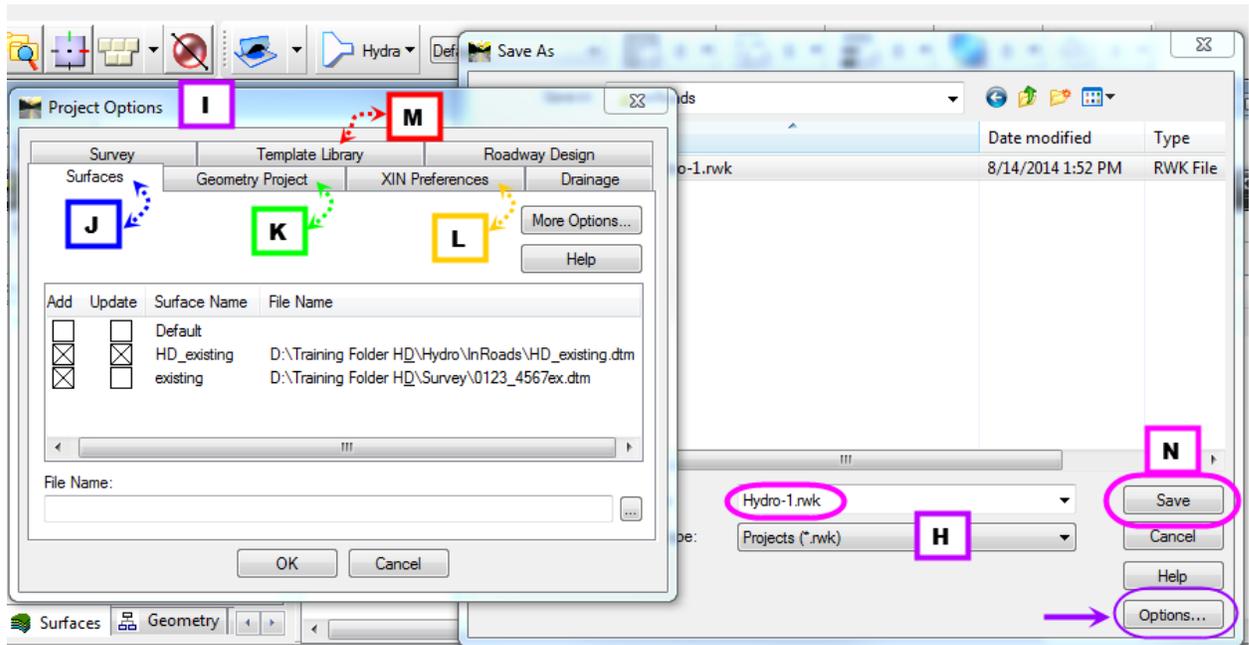


Figure 8 - Save *.rwk File

Section 2 Surfaces

A computerized model of a 3-D ground surface is a visual representation of point data. This data, in **X, Y, Z** numerical coordinates, defines the **D**igital **T**errain **M**odel (DTM), also commonly referred to as a surface.

In InRoads, the DTM remains an integral and important part of a project. Feature data resides in the DTM and can be displayed in plan, profile and cross section view. Design analysis and computations are performed on the data in the DTM. The Surface tools allow users to place features, execute commands, view surface properties, and make design modifications to the design surface.

2.1 Types of DTM Display

In the InRoads project, surface representation and features can be displayed in three different views or modes: 3-D Planimetric, Profile, and Cross Section.

- **3-D planimetric view**, commonly referred to as plan, is a top-level aerial view of the entire surface.
- **Profile** is an extracted side view of the vertical elevation of a surface along an entire active horizontal alignment (or just a portion of it).
- **Cross Section** is a portion of the roadway/channel model at a specified location. Displayed in individual graphic windows, each section shows surface configurations perpendicular or at a skew angle to a linear feature, such as the horizontal alignment (often the centerline of the channel/roadway).

Together, these display modes allow users to view, evaluate, and design projects from various important perspectives. Objects in the DTM can be represented in one view or all of these views. For further descriptions see the CTDOT-IR-V8i Guide.

2.2 Features in the DTM

In InRoads, features are important to the design process. A feature is a unique instance of an item or 3-D entity that is represented in the DTM by lines, points, or text. A line is actually a linear segment. Points can be represented as symbols or cells. Annotation is considered text. The following are examples of common design features:

- A single random point
- A single interior boundary
- A flowline

- A single curb line
- A single utility (pipe, pole, manhole)
- A collection of utilities (poles, manholes)

Therefore, a feature is any single component that is part of the DTM. Further, for features such as random points, users can store more than one random point feature type in a DTM. This flexibility allows users to control the display of the random points in the surface separately from other features, such as manholes.

In InRoads, features can be created or imported into the DTM with a level of “intelligence”. In other words, features know to display themselves as features in InRoads. Once features are defined or modified and displayed, they can be annotated within the design file.

2.3 Surface Tools

In InRoads users can easily copy, copy a portion, merge or transform a surface. Use InRoads Help to further discover the various InRoads surface commands.

2.3.1 LAB – 3 Copy Surface

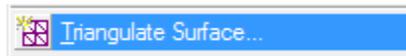
- A. Before starting this lab the **123_0123ex.dtm** file will need to be opened if it is not already. Make sure the existing surface is **active**, red box around the surface symbol.



- B. Make sure the **style lock** is **off**. The style lock will allow the dialog box to appear.



- C. On the InRoads Main Menu Bar click on **Surface > Triangulate Surface**,



make sure existing is active. Click **Apply** and **Close**.

- D. Click on **Surface > View Surface > Triangles**. Click on **Preferences... > select Survey > Load > Close**. In the View Triangles box select **Apply**.
- E. Review and check in the MicroStation file the triangles just created to see if all necessary data needed for the channel is available.
- F. Turn **on Graphic Group** in MicroStation and **delete** the **triangles**.

- G. In InRoads click on **Surface > Copy Surface**. In the Copy Surface dialog box, select the **existing** surface from the pull-down. Should be the only surface available. In the **To** portion for Name type in: Name: **HD_existing**, Description: **Hydro_existing ground** and for **Preference: existing**. Click **Apply** and **Close**. See Figure 9.

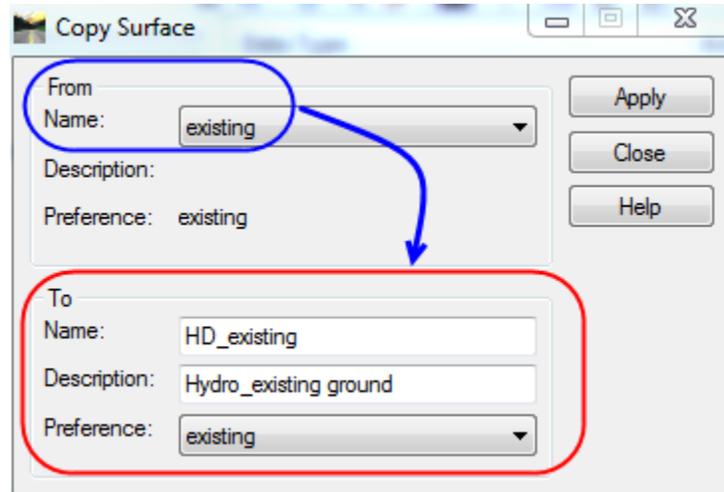


Figure 9 - Copy Surface

- H. In MicroStation **turn off** the survey and highway design (if attached) **reference files**. In InRoads make sure **HD_existing** is the **active** surface. Click on **Surface > View Surface > View Contours**.  Click **Preferences... > Highway > Load > Close**. In the View Contours box select **Apply**.
- I. Turn on the **survey reference** file with the contour levels on. The contours just created in InRoads should be directly on the contours from the reference survey file.
- J. **Delete** the contours, turn on Graphic Group and delete.
- K. Save the HD_existing surface. Right-click on **HD_existing > Save As**. Click on Active bar. File name should be populated with **HD_existing.dtm**. Click on **Save** and then **Cancel**.
- L. Click on **File > Save As**. Save as type: select **Projects (*.rwk)**, select **Hydro-1.rwk** previously created. Click on **Options...**, on the Surfaces Tab click on **Add** and **Update** for the **HD-existing** surface. Click **OK**. In the Save As dialog box click **Save**. Question: File already exists, do you want to replace? May come up, Click **Yes**. Then **Cancel**. Also see Figure 8.

2.4 Creating Horizontal Alignment

For InRoads to develop cross sections and profile, a horizontal alignment must be present or created. The user should use MicroStation first to place lines for the existing channel centerline

alignment. When the graphical solution is developed the InRoads Horizontal Curve Set tools should be used to create a Horizontal alignment for the channel.

2.4.1 LAB – 4 Creating Horizontal Alignment

- A. In MicroStation select Hydraulics line style **HH-Hydrology-MISC-notes**. Activate the **Place SmartLine** command. In the View window place a line in the center of the existing channel (**start from downstream to upstream**) for the entire length of the channel. Zoom in as necessary.
- B. Toggle Off AccuSnap. >> Toggle On ACS Plane. In AccuDraw 'Z' direction type in 0.00, Hit Enter. Start the smart line command. These steps help keep the line on a one elevation (0.00)
- C. Check the line just placed and modify as necessary.
- D. **Turn off survey** reference file.
- E. In InRoads select the **Geometry tab**. Make the previously created Horizontal Alignment **Hydro-1 active**.
- F. Create the horizontal alignment. Click on **Geometry > Horizontal Curve Set > Add PI**. (Figure 10)

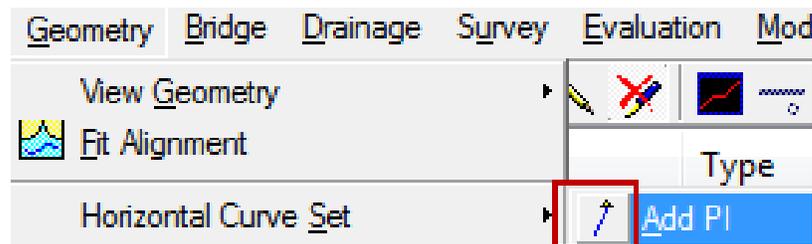


Figure 10 - ADD Horizontal PI

Starting from downstream to upstream. Data point at each change of direction on the smart line placed in MicroStation. At the end of the smart line, **right-click twice** once to end the alignment and second to end the Add PI command.

- G. Now in MicroStation **delete** the horizontal graphic placed with SmartLine and the InRoads alignment, make sure Graphic Group is on.
- H. Redisplay the horizontal alignment. Select **Geometry > View Geometry > Active Horizontal**.

- I. Set Stationing. Click on **Geometry > Horizontal Curve Set > Stationing**. In Stationing dialog box select **Hydro-1** for Horizontal Alignment. Starting Station **10+00**. **Apply** and **Close**.
- J. Apply Stationing. **Geometry > View Geometry > Stationing**. Click on **Preferences.. > Highway > Load > Close**. Pick **Hydro-1** from Horiz. Alignment pull-down. **Click on Limits**. **Click off Cardinal Stations**. Click **Apply** and **Close**.
- K. If you want to edit the horizontal alignment, you can use the move, insert and delete PI commands. Make sure you delete the graphics and redisplay the alignment and redisplay the stationing.

2.5 Creating and Importing Surfaces Features

After the horizontal alignment is established as the centerline of the channel the left and right bank and left and right overbank of the channel need to be added to the HD_existing dtm. This again will involve MicroStation and InRoads commands.

2.5.1 LAB – 5 Creating and Importing Surface Features

- A. In MicroStation make sure **accusnap** is **OFF** and the **ACS plane** lock is **ON**, (Figure 11).



Figure 11 - Snaps & Locks

- B. Select the level **HH-Hydraulics-L-Chnl Bnk**, select the **smartline** drawing command and **place a line** in the MicroStation view for the **left bank and left overbank** from down-stream to up-stream (Figure 12). **Repeat** these steps for **right bank and right overbank** using level **HH-Hydraulics_R-chnl Bnk**. **Turn off** the survey file.

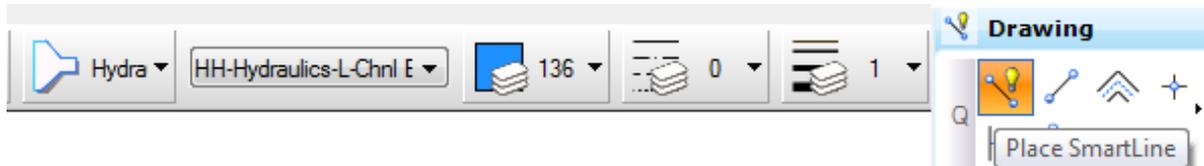


Figure 12 - Level Symbology & Smart Line Command

- C. In InRoads making sure **HD_existing** is active. Click on **File > Import > Surface**. In the Import Surface dialog box click on the **From Graphics Tab**. Select for Surface: **HD_existing**, Load From: **Single Element**, Elevations: **Drape Surface**, Intercept Surface: **HD-existing**. Select for Features: **Toggle on Use Tagged Graphics Information**, Feature Style: select from drop-down **Ex_LT_Ch_Bank**, **type** the same name into the space for **Seed Name**, Point Type should be set to **Breakline**. Click **Apply**; Figure 13. Follow the command prompts in the MicroStation command prompt bar. **Data Point** on the **Left Channel Bank line** drawn in MicroStation. **Accept** the line or **Reject** if you picked the wrong line.

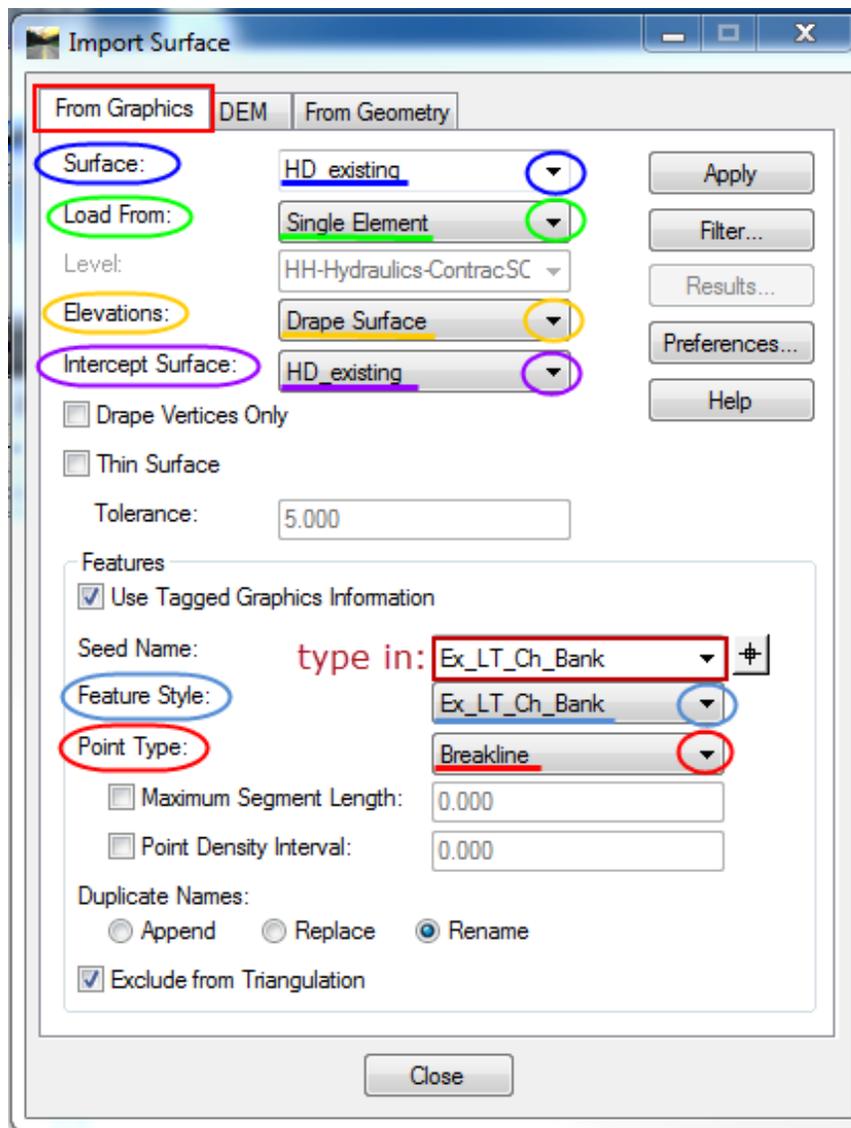


Figure 13 - Import Surface

- D. **Repeat** these steps for the following features: **Ex_LT_Ch_OverBank**, **Ex_RT_Ch_Bank** and **Ex_RT_Ch_OverBank**.
- E. **Close** the Import Surface dialog box; Figure 13.
- F. Click on **Surface > View Surface > Features**. In the View Features dialog box **select each feature line** just imported into the surface. Make sure **HD_existing** is the selected surface. From Features: select **Ex_LT_Ch_Bank** and click **Apply**. A line should appear in the MicroStation window over the line drawn for the existing left channel bank. **Repeat** for the other features: **Ex_LT_Ch_OverBank**, **Ex_RT_Ch_Bank** and **Ex_RT_Ch_OverBank**; see Figure 14

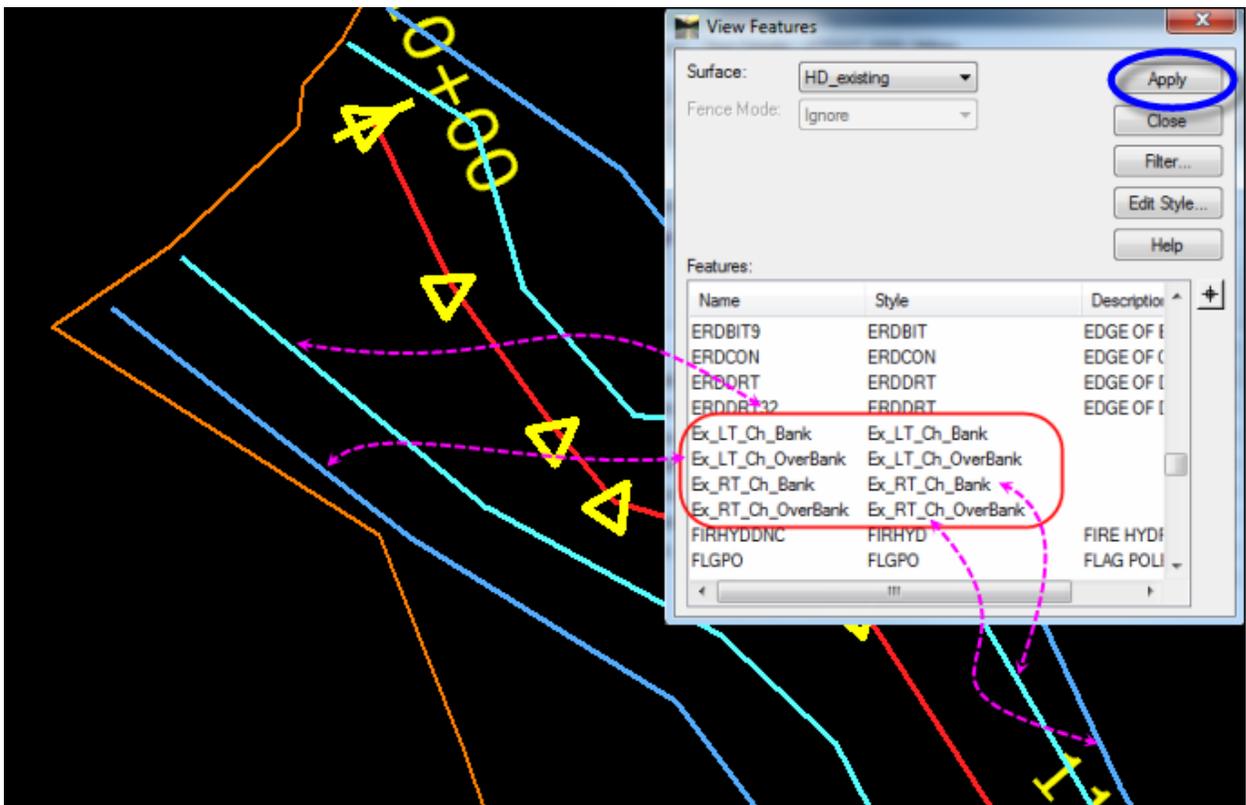


Figure 14 - View Features

- G. Re-Triangulate the surface. Click on **Surface > Triangulate Surface**, select **HD_existing**, click **Apply** and **Close**.
- H. Redisplay the triangles. Select **Surface > View Surface > Triangles**. In the View Triangles select **HD_existing**. **Preferences...** select **Highway**, click **Load** and **close**. Click **Apply** and **Close**.

- I. In MicroStation view you will see that the triangles break at the bank lines. Delete the triangles.

Section 3 Profile and Cross Sections

To view a profile or cross sections of your channel in InRoads a horizontal alignment is necessary. With the horizontal alignment active InRoads can create a profile and cross sections at specified intervals.

3.1 Profile

A profile is a view generated along a defined horizontal geometry.

3.1.1 LAB – 6 Profile

- A. Zoom out of the plan view in MicroStation, enough room is needed to place the profile.
- B. In InRoads select > Evaluation > Profile > Create Profile.
- C. Make sure Highway preferences are active. Select HD_existing for Surfaces. Source > Window and Data. Click Apply.
- D. In MicroStation select the location you want to place the profile and data point. A profile will be placed graphically in MicroStation. In our example draw the box culvert or display drainage structures. See Figure 15.
- E. Close the Create Profile box.

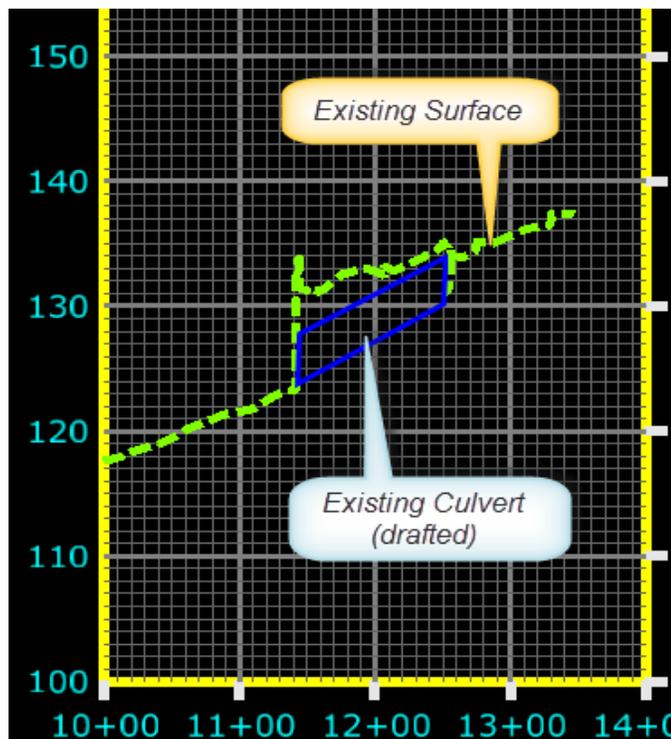


Figure 15 - Existing Profile

3.2 Cross Sections

Cross sections are used to display surfaces and features in a vertical plane. Normal cross sections are cut at a specified interval perpendicular to the channel geometry (horizontal alignment).

3.2.1 LAB -7 Cross Sections

- A. Zoom out of the plan and profile views in MicroStation, enough room is needed to place the cross sections.
- B. In InRoads select > **Evaluation > Cross Section**. In the Cross Sections dialog box load the **Highway preferences** if not already loaded.
- C. Open the **Create Cross Section** folder, in **General** select **Window and Data, Interval: 50** or what best suits your need. Select **HD_existing** for Surfaces. Click **Apply**. In **MicroStation** select a location and **data point** on it. Cross Sections will be placed graphically in MicroStation. See Figure 16.

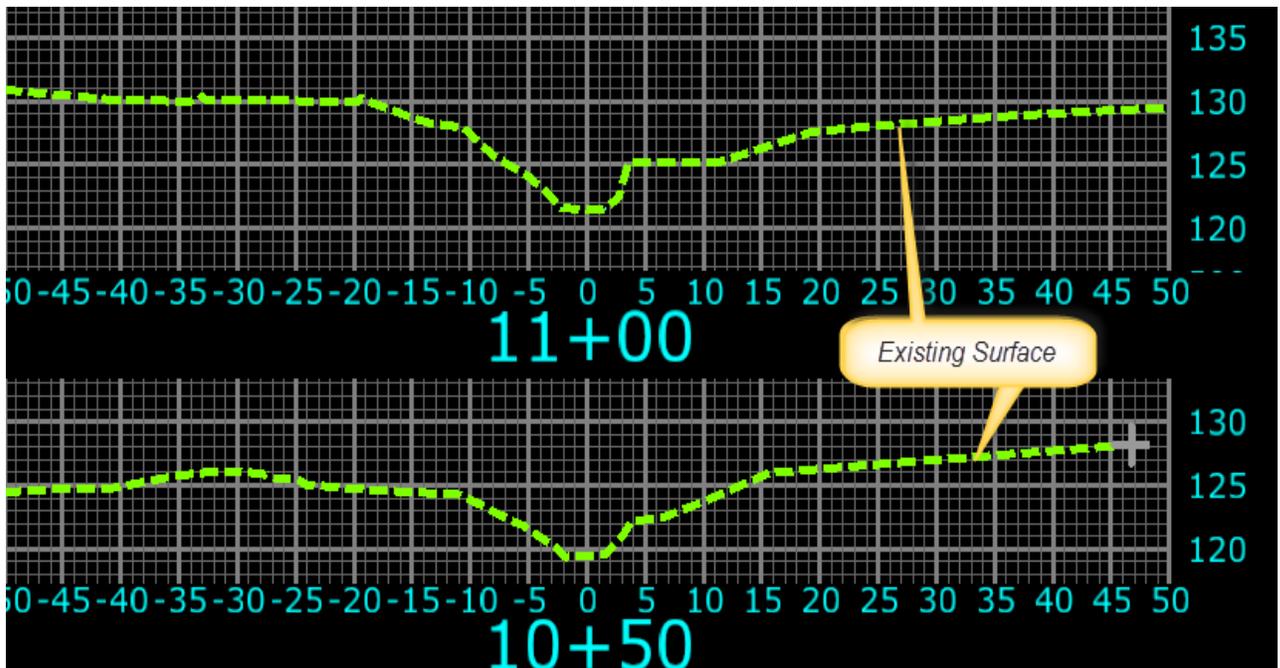
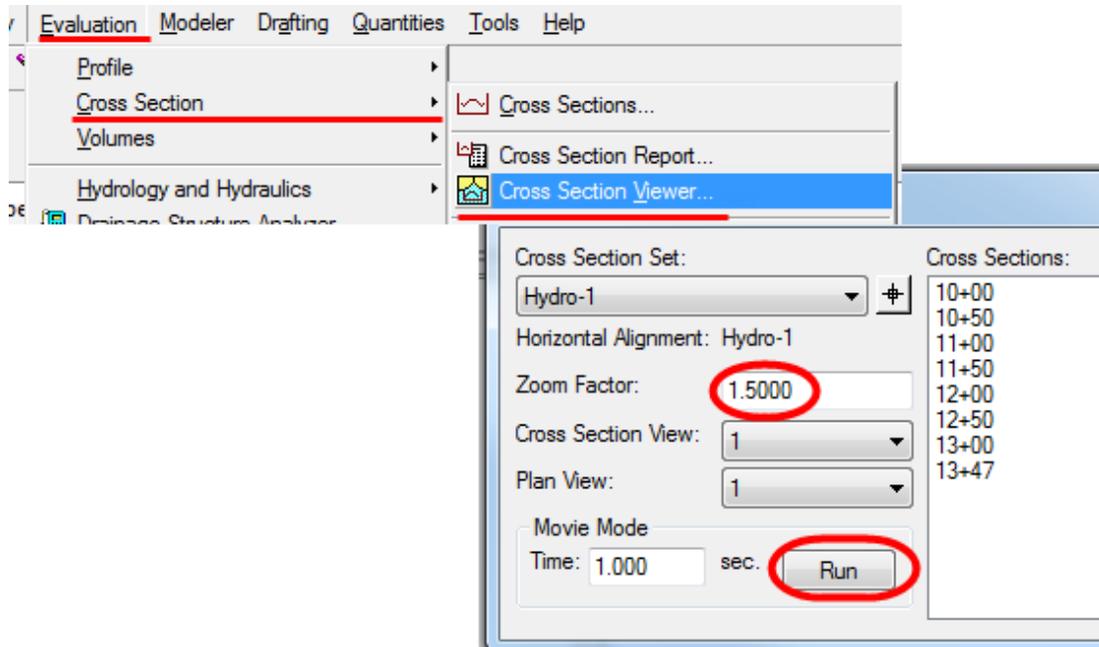


Figure 16 - Single Cross Section

- D. Close the Create Cross sections box.
- E. You can easily view the cross sections just created. Select Evaluation > Cross Section > Cross Section Viewer. Under Cross Section Set: select the set you want to review, for this lab Hydro-1. Select 1.5 as Zoom Factor, select the view window you want to view

Connecticut Department of Transportation Workflow for InRoads Export to HEC-RAS

the sections in (for this lab 1) do the same for Plan View. For Movie Mode 0.5 sec. as time interval and click Run. Each cross section will be viewed for 0.5 sec. Click Close. This allows you to get a general view of the channel cross section.



Note: The cross sections created with InRoads are not necessarily the cross sections you will use for the HEC-RAS model.

Section 4 HEC-RAS Sections

When you review the channel in plan view, profile and cross section you can determine where the HEC-RAS sections should be cut. They may not follow the InRoads cross sections.

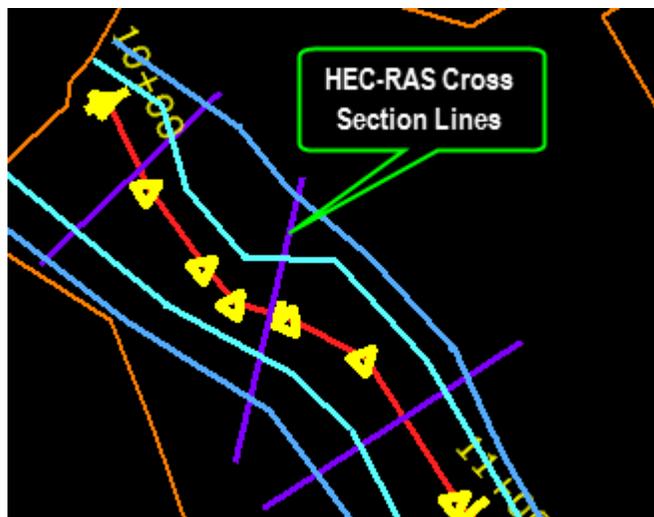
4.1 Create HEC-RAS Sections

4.1.1 LAB – 8 Develop HEC-RAS Sections

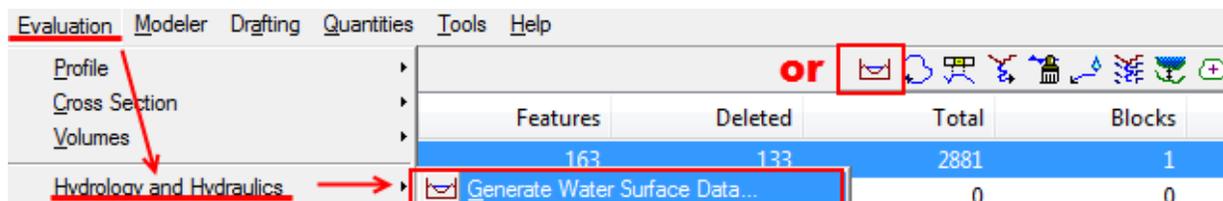
- A. In MicroStation **zoom in to** the horizontal alignment for the channel.
- B. Select **smart line** command and select **level HH-Hydraulics-X-sect**.



- C. **Place lines** in the plan view of the channel where you want HEC-RAS cross sections.



- D. In InRoads select **Evaluation > Hydrology and Hydraulics > Generate Water Surface Data**. If Hydrology and Hydraulics is not available from the pull-down, select **Tools > Application Add-Ins > Hydrology and Hydraulics Add-In**. Click **OK**. Now go to Evaluation etc.



Connecticut Department of Transportation Workflow for InRoads Export to HEC-RAS

- E. Select the **Cross Sections Tab** and for Source choose **Selection Set**. Leaving this dialog box open. See Figure 17.
- F. In MicroStation use the **Element Selection tool** and **select all the cross section line strings** you placed.
- G. Back in the InRoads Generate Water Surface Data dialog box. Select the following: **Surface > HD-existing, Alignment: > Hydro-1, Create: > Section Data, Section Format: > HEC-RAS, Maximum Points: 99**.
- H. Enter the Stream Id and Reach ID that you want to use in the HEC-RAS model. For this lab use: **Stream-1 and Reach-1** respectively.
- I. In the dialog box under **Banks**, click on the **crosshair button** for the **Left Bank:** and select the **feature line for the left bank** in the MicroStation window. **Repeat** for the **Left Over Bank, Right Bank and Right Over Bank**.
- J. **Click Apply**. The Save As window will open. Save the ***.geo** file in the **HEC-RAS folder**. For this lab save as **Hydro-1.geo**.

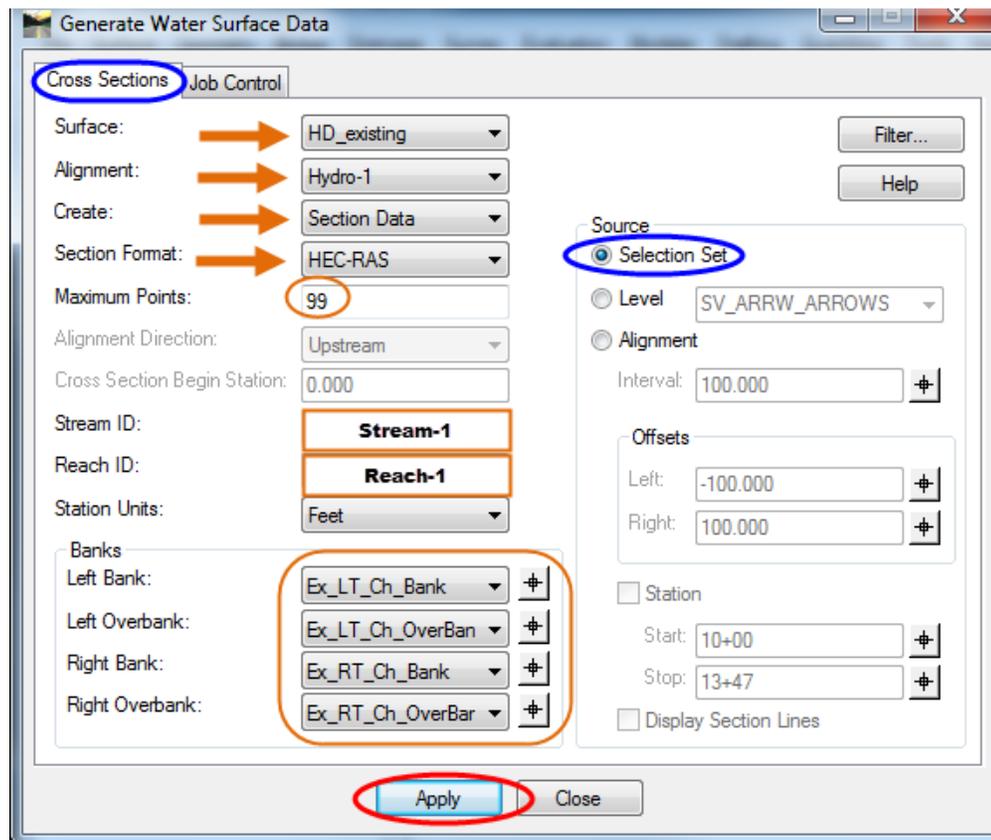


Figure 17 - Generate Water Surface Data

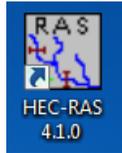
Connecticut Department of Transportation Workflow for InRoads Export to HEC-RAS

- K. You can also extract HEC-2 data. Under Section Format choose HEC-2, click apply and save the data file.
- L. If you have data for starting flow, water surface elevation, manning's coefficients click on the Job Control tab in the Generate Water Surface data and enter the data you have, not applicable for HEC-RAS.
- M. **Close** the Generate Water Surface dialog box. In InRoads select **File > Save As >** ; select **Projects (*.rwk)** and click on **Options....** In the Project Options dialog box make sure **Add** and **Update** are selected for **HD_exsiting** surface and **Hydro-1** geometry project. Save the project. For this lab save as **Hydro-1.rwk**.
- N. You are now finished with the InRoads portion. You can exit InRoads and MicroStation if you want, ensure your work is saved.

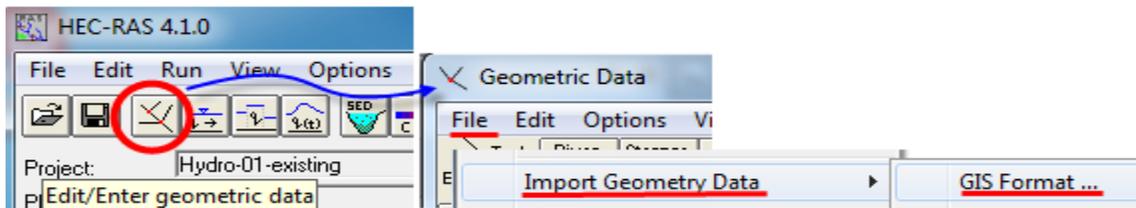
Section 5 Import InRoads Data to HEC-RAS

As stated earlier – it will probably be more efficient to edit channel banks and River Station names within HEC-RAS rather than rerunning Inroads.

Open HEC-RAS from your desktop, **Double -Click** the icon.



- A. Click on **File > New Project**. Type in **Hydro-1 existing** as Title, this populates the File Name box with **Hydro-1 existing.prj**. **Browse** to your project directory's HEC-RAS folder. Click **OK** to create the project and folder.
- B. Click on **Edit/Enter geometric data**, Click on **File > Import Geometry data > GIS Format**.



- C. Select the **Hydro-1.geo** file created using InRoads. Click **OK**. Select **US Customary units**. Click **Finished - Import Data**.
- D. The channel center line with the HEC-RAS cross section lines should appear in the **Geometric Data box** (see Figure 18).
- E. **Click** on the cross section icon and the **Cross Section Data box** opens. Work the data as needed.
- F. Should you need proposed channel data, request the proposed surface (Design surface) from Highway Designer and repeat all the steps using proposed symbology:
Pro_CL_Channel, Pro_Hydro_XSC, Pro_LT_Cha_Bank, Pro_LT_Cha_Over_Bank,
Pro_RT_Cha_Bank and Pro_RT_Cha_OverBank.

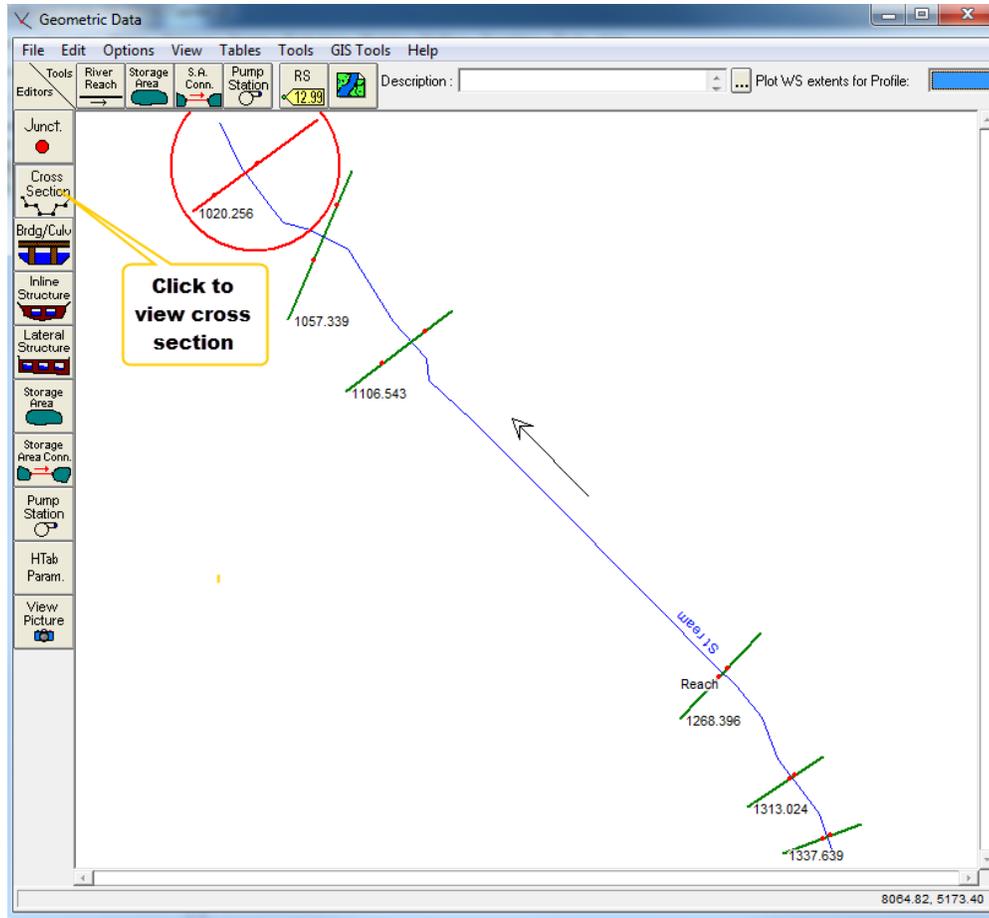


Figure 18 - Geometric Data box

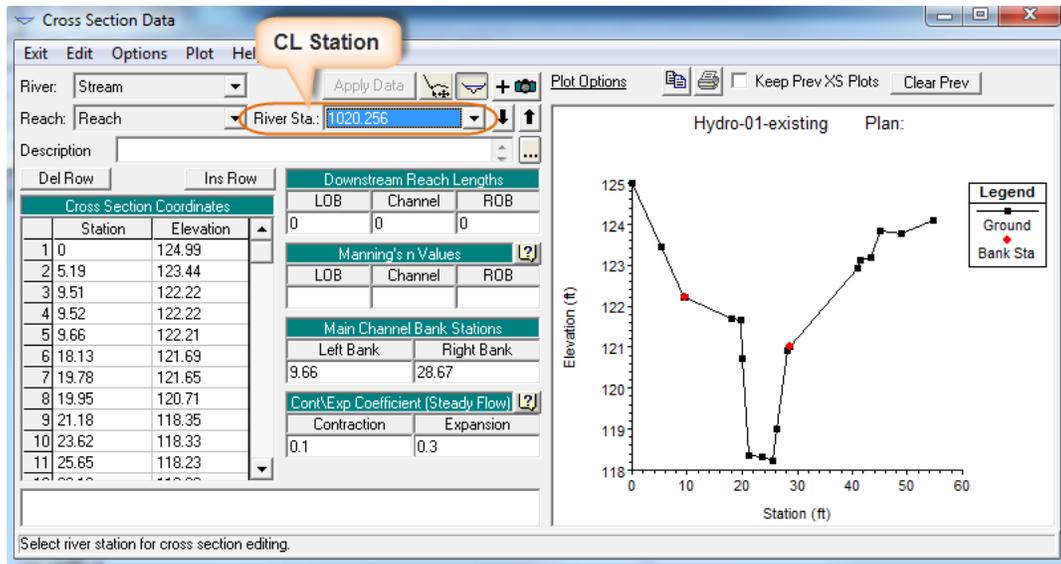


Figure 19 - Cross Section Data box